Jonathan Cylus, M. Maria Glymour, Mauricio Avendano

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Do generous unemployment benefit programs reduce suicides? A state fixed-effect analysis covering 1968-2008

Authors: Jonathan Cylus [1,2], M. Maria Glymour [3,4], Mauricio Avendano [1,3]

Affiliations:

1. LSE Health, Department of Social Policy, London School of Economics and Political Science, London, United Kingdom
2. European Observatory on Health Systems and Policies, London, United Kingdom
3. Department of Social and Behavioral Sciences, Harvard School of Public Health, Boston, USA
4. Department of Epidemiology & Biostatistics, University of California, San Francisco, USA

Address for correspondence:
Jonathan Cylus
Cowdray House
London School of Economics and Political Science
Houghton Street
London WC2A 2AE
Tel.: +44 20 7955 7203
E-mail: j.d.cylus@lse.ac.uk

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Abstract

The recent recession has led to increases in suicide, but whether US state unemployment insurance programs ameliorate this effect has not been examined. Exploiting US state variations in the generosity of benefit programs between 1968 and 2008, we tested the hypothesis that more generous unemployment benefit programs reduce the impact of economic downturns on suicide. Using state linear fixed-effect models, we find a negative additive interaction between unemployment rates and benefits among the working age population (Beta=-0.57, 95% confidence interval: -0.86, -0.27, p<.001). The finding of a negative additive interaction was robust across multiple model specifications. Our results suggest that the impact of unemployment rates on suicide is offset by the presence of generous state unemployment benefit programs, though estimated effects are small in magnitude.

Keywords: unemployment; suicide; social epidemiology; benefits; recession

Running head: Unemployment benefit programs and suicide rates

Introduction

Previous studies suggest that economic downturns are associated with increased suicide rates(1-4), particularly among working age males(5, 6), who are at increased risk of job loss during recessions(7). An important question is whether unemployment insurance policies aimed at mitigating the financial hardship associated with job loss reduce the number of suicides associated with rising unemployment rates(8). During the recent recession, family incomes fell on average 40% for long-term unemployed workers, and slightly more than a quarter of unemployed workers experienced economic hardship after job loss. It is estimated that income would have fallen even more without the protection afforded by unemployment insurance, which replaced 43% of lost earnings for long-term unemployed workers claiming benefits(9). While research has documented an increase in suicide when the economy worsens(2-4, 10-14), no studies have examined the potentially offsetting impact of unemployment benefit programs in the US.

Unemployment benefit programs could be expected to protect against suicide risk through a number of potential pathways. First, benefits may mitigate the impact of individual job loss on suicide by providing a social safety net for the unemployed and their families, which may be reflected in lower overall suicide rates during recessions when in the context of generous unemployment benefits. Second, the presence of unemployment benefit programs may provide comfort to the employed at risk of job loss, thereby reducing negative mental health effects associated with stress (15, 16).

Most previous studies linking unemployment benefit programs to health have focused only on the association between actual receipt of unemployment benefits and self-rated health among the unemployed. In general, these studies suggest that unemployed workers receiving benefits have better subjective and mental health than unemployed workers who do not receive unemployment benefits(17-19). A potential caveat of these studies is the strong selection associated with claiming or being eligible for unemployment benefits. Eligibility to receive benefits, as well as the amount of benefits received, is determined based on a worker's career, salary, and reason for job loss; each of these factors is plausibly an independent predictor of suicide. In addition, only about two-thirds of eligible workers claim benefits(9). As a result, unemployed workers receiving benefits are a selected sample differing in key characteristics from unemployed workers not receiving or ineligible for benefits. Using cross-country data from European countries, an earlier study examined whether national aggregate expenditures on unemployment cash benefits modified the impact of unemployment rates on suicide mortality, but found no evidence of an effect(2). A potential problem with this approach is that aggregate spending on unemployment cash benefits reflects both program generosity as well as the number of unemployed individuals in receipt of benefits. If unemployment cash benefits increase when the unemployment rate increases, an interaction will yield potentially biased estimates of the contribution of unemployment insurance benefits to reducing suicides associated with recessions.

Building on prior research(2, 17-19), we exploit the large variation in maximum allowable unemployment benefit laws over the last decades across US states to investigate whether more generous benefit programs reduce the number of suicides

associated with recessions. The Federal-State Unemployment Insurance Program, created by The Social Security Act of 1935, provides states with autonomy to organize the program provided some conditions on coverage and eligibility are met. Although the dollar value of benefits received is individually determined, state laws define the maximum amount and duration of benefits that workers are entitled to receive after job loss(20). Importantly, changes in state laws are presumably uncorrelated with state suicide rates, demographics or other state characteristics. Prior research also suggests that changes in unemployment benefit policy are unrelated to changes in other state programs(21). While our approach does not enable us to identify the direct effect of benefits on the unemployed, it allows us to estimate whether the impact of recessions on suicide is offset by increased unemployment benefit generosity. Following other studies that examine the link between mortality rates and labor market conditions, we also investigate whether there are heterogeneous effects by age group and gender.

Methods

Data

Data on maximum unemployment insurance eligibility benefits were obtained from the US Department of Labor Employment and Training Administration(22). Maximum Benefits were disaggregated by the maximum allowable amount per week (in US dollars) and the maximum number of weeks workers were entitled to receive benefits. These two values were multiplied to obtain the total allowable benefit level in a given year. All amounts were adjusted to constant US dollars using the Consumer Price Index for All Urban Consumers obtained from the Bureau of Labor

Statistics. We used the natural log of benefit levels to calculate the effect of a proportional increase in maximum benefit levels.

State suicide deaths and population counts came from the US Compressed Mortality Files collected by the Centers for Disease Control and Prevention (CDC WONDER)(23). Data contained the number of suicide deaths by state, year, sex and age-group (ages 20-24, 25-34, 35-44, 45-54, and 55-64). Suicide was defined based on International Classification of Disease codes for suicide and self-inflicted injury E950-E959 (eighth and ninth International Classification of Disease revisions) for 1968 to 1998, and intentional self-harm X60-X84 (tenth International Classification of Disease revision) for 1999 to 2008. The sample comprised 14,557 state-year-age-sex observations, covering 798,600 deaths from 1968 to 2008.

State unemployment rates were calculated based on the March Supplement from the Current Population Survey accessed through the Current Population Survey Integrated Public Use Microdata Series(24). For each state and year, we estimated the sex-specific proportion of individuals aged 30-64 in the labor force reporting to be unemployed. We used the unemployment rate at these ages as an overall indicator of the economic conditions for the working-age population in every state. For each state and year, we also obtained data from the Current Population Survey March Supplement on (a) average real state wages and salaries, adjusted to constant US dollars using the Consumer Price Index for All Urban Consumers and (b) the state-specific distribution of the population's educational attainment. Additionally controlling for state-specific race distributions did not change estimates due to little

change over time in race composition within states, so this variable was not included in the final models.

Methods of analysis

Studies have emphasized that measuring effects on the additive scale is most appropriate for assessing the public health relevance of an exposure(25, 26). Therefore, we modelled the absolute suicide mortality rate in a linear ordinary least squares model. We chose this approach because multiplicative models, such as Poisson or log-linear models, impose the assumption that effects of changes in unemployment rates and benefits are a function of the underlying suicide rate in a community. Therefore, in a community with high background suicide rates, multiplicative relationships would imply that increases in unemployment would have larger absolute effects on the number of suicides than in a community with a low background suicide rate. In contrast, additive models allow for the possibility that a certain number of individuals in the population commit suicide when unemployment rates increase-- regardless of the background suicide rate in the community -- and that among these individuals who become suicidal in the context of higher unemployment rates, some are protected by generous unemployment benefits. In supplementary models, we also implemented a negative binomial model with the number of deaths as outcome variable and the log of persons as the offset variable to test for a multiplicative interaction. We chose a negative binomial model over a regular poisson model to account for overdispersion.

The basic model has the following generic form:

$$D_{jtag} = \alpha_t + U_{jtg}\beta + UB_{jt}\delta + X_{jt}\theta + U*UB_{jt}\omega + S_j + S_j*T + \varepsilon_{jt}$$

Where D is the mortality rate for state j at year t stratified by age a and sex g, U is the sex-specific state unemployment rate, α is the year-specific intercept, UB is the maximum state unemployment benefit for a given year, X is a vector of controls, S is a state fixed effect, S*T is a vector of state-specific linear time trends, and ε is the regression error term. State fixed effects control for all time-invariant differences across states and use only within-state variation over time to identify the impact of unemployment and benefits on suicide. Year fixed effects control for factors affecting trends in suicide at the national level. State-specific linear terms control for state-specific factors that linearly affect state trends. X is a vector of controls including age, sex, cohort population size, the log of average state wages and salaries, and the percentage of the population with a college degree.

Our key estimate of interest is U*UB, which assesses the interaction between unemployment rates and unemployment benefits. We assess the interaction between these variables to test whether larger maximum unemployment benefits offset the impact of an economic downturn – proxied by an increase in the state unemployment rate - on suicide. In stratified models, we also investigated whether effects of unemployment rates and benefits differed by age and gender. All models were based on robust standard errors clustered at the state level.

Results

Trends in suicide rates and the generosity of unemployment benefits varied considerably across US states (Table 1). Nevada had the highest suicide rates (36.5 deaths per 100,000 population), while suicide rates were lowest in the District of

Columbia (8.8 per 100,000). Massachusetts has historically provided the highest maximum unemployment benefits, while Mississippi has had the lowest average benefits.

<Table 1 about here>

Figure 1 shows age- and sex-standardized suicide rates plotted against state unemployment rates, separately for states and years above (solid line) and below (dotted line) the mean of benefits across all states and years ($7990 US constant dollars). Total suicide rates increased as unemployment rates rose. However, the positive association between unemployment rates and suicide was greater for states and years with maximum unemployment benefits below the sample mean as compared to states and years with more generous unemployment benefits.

<Figure 1 about here>

Table 2 summarizes results from the linear additive models (full model estimates are shown in Web Table 1). Controlling for all confounders, a one-percentage point increase in the state unemployment rate was associated with 0.16 (95% confidence interval: 0.076, 0.24) more suicide deaths per 100,000 population (Model 1, Table 2). Incorporating both unemployment rates and benefits (Model 2), the effect of maximum unemployment benefits was null (-0.10, 95% confidence interval: -1.62, 1.42). Model 3 shows that there was a negative interaction between the state unemployment rate and maximum unemployment benefits (Beta=-0.57, 95% confidence interval: -0.86,-0.27), suggesting that the impact of unemployment rates

on suicide was offset by higher unemployment benefits. Again, the main effect of maximum unemployment benefits was null (Beta=0.20, 95% confidence interval: -1.31, 1.71). Alternative models including maximum benefits as share of average state wages and salaries showed similar results. Despite the additive interaction, we found no evidence of a multiplicative interaction between unemployment rates and benefits in negative binomial models, as confidence intervals were wide and crossed the null (Web Table 1).

< Table 1 about here>

To better illustrate the findings in Model 3, Figure 2 shows the number of additional suicides predicted by unemployment rates for scenarios where unemployment benefits are above and below the historical mean ($7990 US constant dollars per person). Higher unemployment rates predicted higher suicide rates, but this association was steeper when unemployment benefits were low.

<Figure 2 about here>

We next investigate whether the observed effects of unemployment benefit programs were consistent by gender and age group. Figure 3 shows the estimated interaction term from these stratified models; estimates for main effects of unemployment rates and benefits are shown in Web Figures 1 and 2. Although confidence intervals were wide in gender-specific models, the additive interaction term was negative for both men (Beta=-0.22; 95% confidence interval: -0.51, 0.080) and women (-0.13; 95% confidence interval: -0.28, 0.021); effects did not differ by gender. Among all age

groups there is a negative interaction between unemployment rates and benefits, so that the impact of unemployment rates on suicide was offset by larger unemployment benefits; estimates for ages 45-54 were similar but confidence intervals were wider. Although unemployment benefits appeared to mitigate the impact of increased unemployment most markedly for those aged 20-24 years, there were no clear differences across age groups.

<Figure 3 about here>

Robustness checks

We conducted several robustness checks to verify our results. Introducing state quadratic time trends in addition to, or in place of linear time trends produced similar results; eliminating time trends altogether also did not materially affect the results. We also examined whether our results hold when allowing state and year fixed effects to be gender-specific and find that while the estimated effects are smaller in magnitude, the additive interaction remains negative (p=0.06) (Web Table 2). To ensure that our models are robust to possible autocorrelation, we re-ran our models using Newey-West standard errors, which are used when the error structure is assumed to be heteroskedastic and possibly autocorrelated up to some lag, which we set at 10 years. We also tested Prais-Winsten models, which use generalized least-squares to estimate linear regression models where the errors are serially correlated following a first-order autoregressive process. Lastly, we experimented with autoregressive models that include lagged dependent variables. In all instances our results were consistent.

As a falsification test, we implemented the main models on neoplasm mortality rates instead of suicide rates, where we expected to observe no effects of unemployment and benefits(27). Accordingly, we found no effect of unemployment, benefits, or the interaction term on neoplasm mortality at accepted levels of statistical significance ($p<0.05$) (Web Table 3). We experimented with an alternative model that included weekly unemployment benefit claims for each state instead of annual unemployment rates, to account for the fact that many unemployed workers are ineligible or do not claim benefits. Results did not notably differ from those based on the unemployment rate. Lastly, the number of suicides in some state-year-age-sex combinations was low, which may have led to imprecise results; we re-estimated models based on aggregated age standardized data at the state-year-sex level and obtained similar results in all instances.

Discussion

Our study was motivated by recent studies suggesting that economic recessions increase the risk of suicide(2, 4, 10, 11). Previous research found no protective effect of unemployment benefit expenditures across European countries(2). Our study, based on data on program generosity rather than expenditure levels, suggests that unemployment benefit programs in the US are associated with a reduced impact of economic downturns on suicide. We found no evidence of differential effects of unemployment benefits across age or gender.

While we found an additive interaction between unemployment rates and benefits, we found no multiplicative interaction using negative binomial models, as confidence

intervals were wide. When main effects operate in the same direction, models that are less than additive must be much less than multiplicative, and therefore also will reveal an interaction on a multiplicative scale. However, a sub-additive interaction need not necessarily imply a sub-multiplicative interaction when the main effects operate in opposite directions, as with unemployment rates increasing suicide risk and unemployment benefits expected to decrease suicide risk. In this instance, multiplicative models imply a risk that is closer to the null than the risk implied by an additive effects model. Similarly, we find evidence that the effects deviate from an additive scale, but they do not deviate significantly from a multiplicative scale. This finding is also consistent with our expectation that the effect of unemployment benefits does not vary with the baseline suicide rate. This illustrates the fact that unemployment rates themselves account for only a small fraction of all suicides, with other factors such as divorce rates, alcohol regulation and gun laws being potentially more important(28). The statistical power to detect a multiplicative interaction may also be less than the power to detect an additive interaction.

Our results shed some light on the mechanisms linking unemployment rates to suicide. Theoretically plausible mechanisms linking economic conditions and unemployment to suicide include financial distress, stigma, social isolation, or reduced “meaning in life.” We find that larger maximum cash unemployment benefits mitigate the impact of increasing unemployment on suicide rates. This interaction between unemployment rates and benefit generosity suggests that the increase in suicides during recessions may partially be due to income loss among the unemployed or fear of income loss among other groups during periods of economic uncertainty. Economic recessions have previously been linked to increased levels of

job insecurity and psychological distress, even among those who do not experience job loss(15, 16). Unemployment benefits may therefore protect against suicide by providing a social safety net for all workers at risk of unemployment and their families, mitigating the negative mental health effects of job insecurity.

Consistent with our results, previous evidence suggests that the association between unemployment and mortality may be modified by the institutional context(18, 29). For example, prior research suggests that higher expenditures in labor market programs mitigate the impact of economic downturns on mortality (2). Similarly, generous unemployment benefit levels might reduce the mental health effects of job stress and insecurity associated with economic downturns (8, 30)

There are a number of limitations to our analysis. While our study suggests that unemployment benefit policy mitigates the effects of unemployment rates on suicide, it does not address the question of whether receiving unemployment benefits during individual unemployment spells directly affects suicide risk. Additionally, while prior research finds that changes to unemployment benefit programs are uncorrelated with changes in other policies(21), and despite the inclusion of many confounders, our estimates may partially pick up effects of other policies that co-vary with unemployment benefits on suicide rates. Policies such as gun legislation, mental health spending, or other income support programs could be hypothesized to also reduce suicide rates. Nevertheless, it is difficult to imagine that the timing of changes in these or other policies potentially associated with suicide would have systematically coincided with changes in unemployment benefit levels across different states. It is also unlikely that these policies would have an effect on suicide

rates through their interaction with unemployment rates. Lastly, our models assume that unemployment benefit policies are associated with suicide rates concurrently; it is possible that there are long-term effects of unemployment benefits not captured in our models.

Our findings suggest that generous unemployment insurance benefits reduce the impact of economic downturns. Unemployment benefit policies may provide comfort to those who are prone to suicide during economic downturns, highlighting the potential mental health gains of expanding the generosity of benefits. Given the small magnitude of estimated effects, however, raising unemployment benefit levels would likely be an inefficient way to reduce the number of suicides. If benefits similarly influence more common but less severe mental health outcomes, such as depression, the public health impact may be important, but our data do not permit evaluation of other outcomes. Nonetheless, as unemployment benefit programs are not specifically designed to reduce suicide but to smooth consumption(31), the finding that they mitigate the mental health effects of recessions is evidence of a positive unintended consequence of unemployment benefit policies.

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Author affiliations: LSE Health, Department of Social Policy, London School of Economics and Political Science, London, United Kingdom (Jonathan Cylus, Mauricio Avendano); European Observatory on Health Systems and Policies, London, United Kingdom (Jonathan Cylus); 3. Department of Social and Behavioral Sciences, Harvard School of Public Health, Boston (Maria Glymour, Mauricio Avendano); Department of Epidemiology & Biostatistics, University of California, San Francisco (Maria Glymour).

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Table 1. Suicide rates, unemployment rates and maximum unemployment benefits across US States during 1968-2008

	Age/Sex Standardized Suicide Rate per 100,000 Working-age (20-64) population			Unemployment Rate			Maximum Unemployment Benefits, 1999 US$		
	Mean	**Min**	**Max**	**Mean**	**Min**	**Max**	**Mean**	**Min**	**Max**
Alabama	19.5	17.5	22.1	4.8	2.0	8.7	$5,064	$4,039	$6,852
Alaska	23.0	9.1	35.4	7.6	5.1	11.6	$8,855	$6,689	$11,671
Arizona	28.6	23.0	36.6	4.2	1.9	7.0	$5,274	$4,528	$6,471
Arkansas	20.0	14.4	24.7	4.7	2.7	8.0	$7,525	$5,916	$8,550
California	23.2	13.7	35.6	5.4	3.6	8.6	$7,472	$5,783	$10,319
Colorado	28.6	21.0	35.4	4.0	1.3	8.4	$8,490	$7,591	$9,582
Connecticut	14.2	8.7	19.6	4.2	0.6	8.1	$11,646	$9,244	$14,340
Delaware	15.6	5.6	26.0	3.8	1.8	7.2	$7,915	$6,731	$10,006
District of Columbia	8.8	0.0	22.4	5.1	2.0	10.2	$10,634	$7,086	$14,955
Florida	24.6	19.4	30.2	4.0	1.0	6.6	$6,456	$4,722	$7,716
Georgia	21.5	16.1	30.0	3.5	1.1	7.3	$6,034	$4,731	$7,102
Hawaii	13.5	4.9	23.7	3.5	1.9	6.7	$9,250	$7,988	$10,933
Idaho	24.5	16.0	33.2	5.2	2.4	9.7	$7,226	$6,829	$7,862
Illinois	16.0	12.2	19.5	4.7	1.6	8.5	$9,702	$8,412	$10,870
Indiana	20.0	15.9	23.4	4.4	1.5	9.4	$6,907	$5,337	$8,863
Iowa	18.6	14.3	24.3	3.5	1.6	8.5	$8,610	$7,335	$13,294
Kansas	19.9	15.7	23.9	3.3	1.1	5.7	$7,681	$7,090	$8,508
Kentucky	21.9	17.7	25.0	4.8	2.7	9.9	$6,884	$5,533	$8,675
Louisiana	20.6	16.4	26.5	4.9	2.1	9.4	$6,981	$5,144	$10,087
Maine	19.4	9.7	26.9	4.8	2.5	7.9	$9,241	$8,201	$10,401
Maryland	17.2	12.7	23.4	3.3	1.3	6.4	$7,042	$6,309	$8,343
Massachusetts	13.5	9.1	17.0	4.6	1.9	9.3	$16,604	$12,868	$21,708
Michigan	19.9	15.8	25.5	6.0	2.0	11.9	$8,474	$7,150	$10,353
Minnesota	18.0	13.4	23.3	4.0	1.6	6.3	$9,439	$8,252	$11,422
Mississippi	18.1	13.9	22.0	4.9	1.9	10.7	$4,955	$4,289	$6,090
Missouri	21.2	17.8	25.5	4.0	0.9	7.1	$5,695	$4,567	$6,873
Montana	26.6	15.3	37.2	5.2	1.6	8.4	$7,066	$6,351	$8,690
Nebraska	16.9	11.7	24.9	2.7	0.6	4.9	$5,523	$4,617	$6,604
Nevada	36.5	25.9	49.4	4.7	1.8	8.4	$6,994	$6,466	$7,774
New Hampshire	17.5	8.4	27.0	3.7	0.8	7.9	$6,806	$5,569	$8,956
New Jersey	12.0	9.6	14.7	4.8	2.2	9.2	$9,274	$6,910	$11,706
New Mexico	30.5	23.7	40.7	4.9	2.5	8.5	$6,655	$5,868	$9,511
New York	12.9	9.7	16.7	4.9	2.0	7.8	$8,157	$5,610	$10,183
North Carolina	20.9	17.3	25.1	3.8	1.9	7.8	$8,258	$6,218	$9,823
North Dakota	14.3	2.7	23.0	3.7	1.8	5.9	$7,300	$6,535	$8,220
Ohio	19.6	15.2	23.6	4.6	2.1	8.9	$10,046	$7,369	$12,555
Oklahoma	22.6	17.8	26.8	3.7	0.8	7.7	$7,383	$6,471	$8,841
Oregon	24.9	20.4	29.0	5.8	2.9	10.2	$8,338	$6,099	$9,786

Pennsylvania	19.1	16.7	21.0	4.7	2.0	7.5	$10,510	$6,734	$12,453
Rhode Island	11.9	1.4	25.7	5.1	2.3	9.5	$10,823	$7,768	$13,399
South Carolina	19.5	16.2	23.0	4.1	1.2	8.0	$6,152	$4,940	$7,934
South Dakota	17.2	2.0	26.2	3.1	0.9	5.2	$5,601	$4,641	$6,862
Tennessee	22.0	19.4	24.4	4.3	2.2	8.3	$5,805	$4,830	$6,790
Texas	21.1	16.8	24.9	3.8	1.6	7.2	$6,992	$4,796	$8,023
Utah	24.5	20.1	30.5	3.4	1.1	6.3	$8,577	$7,221	$11,777
Vermont	17.8	0.0	32.8	3.9	1.8	6.5	$6,902	$5,876	$8,550
Virginia	21.9	17.0	28.8	2.8	1.4	4.2	$6,698	$5,854	$7,862
Washington	23.1	18.4	28.3	5.5	2.8	9.7	$10,586	$8,824	$14,002
West Virginia	20.2	15.6	24.7	6.1	1.7	13.1	$8,613	$5,784	$11,000
Wisconsin	20.4	17.0	24.4	4.6	2.5	7.6	$8,671	$7,285	$12,618
Wyoming	24.4	7.7	42.8	3.8	1.7	7.8	$7,203	$6,172	$8,090
Total	20.2	0.0	49.4	4.4	0.6	13.1	$7,991	$4,039	$21,708

Table 2. Fixed effects models: The estimated impact of state unemployment rates and unemployment benefits on suicide rates per 100,000 across 50 US states and the District of Columbia, ages 20-64, 1968-2008[a]

	Ordinary Least Squares models					
	Model 1		Model 2		Model 3	
	Coefficient	95% CI	Coefficient	95% CI	Coefficient	95% CI
Unemployment rate	0.16	0.0076, 0.24	0.16	0.0076, 0.24	0.18	0.10, 0.26
Maximum unemployment benefit [b]			-0.1	-1.62, 1.42	0.2	-1.31, 1.71
Maximum unemployment benefit * Unemployment rate					-0.57	-0.86, -0.27
Average real state wages and salaries [b]	-0.5	-2.85, 1.84	-0.47	-2.87, 1.93	-0.52	-2.93, 1.89

[a] All models include: State fixed effects, year fixed effects, state-specific linear trends, age cohort, sex cohort, the log of population size, and the percentage of the population that has graduated college. Unemployment rates and logged maximum unemployment benefits are centered by subtracting mean values 4.423 and 8.950, respectively.
[b] Logged, 1999 prices

Figure 1. Lines of best fit for age-sex standardized suicide rates among the working-age population vs. working-age unemployment rates, total population, United States, 1968-2008

Legend: Death rates are age-sex standardized deaths per 100,000 working-age population. High/low benefit levels are above/below the mean level ($7990 US constant dollars per person). Black dots indicate state-years with high benefit levels; grey dots indicate state-years with low benefit levels. The solid line is the line of best fit through state-years with high benefits; the dashed line is the line of best fit through state-years with low benefit levels.

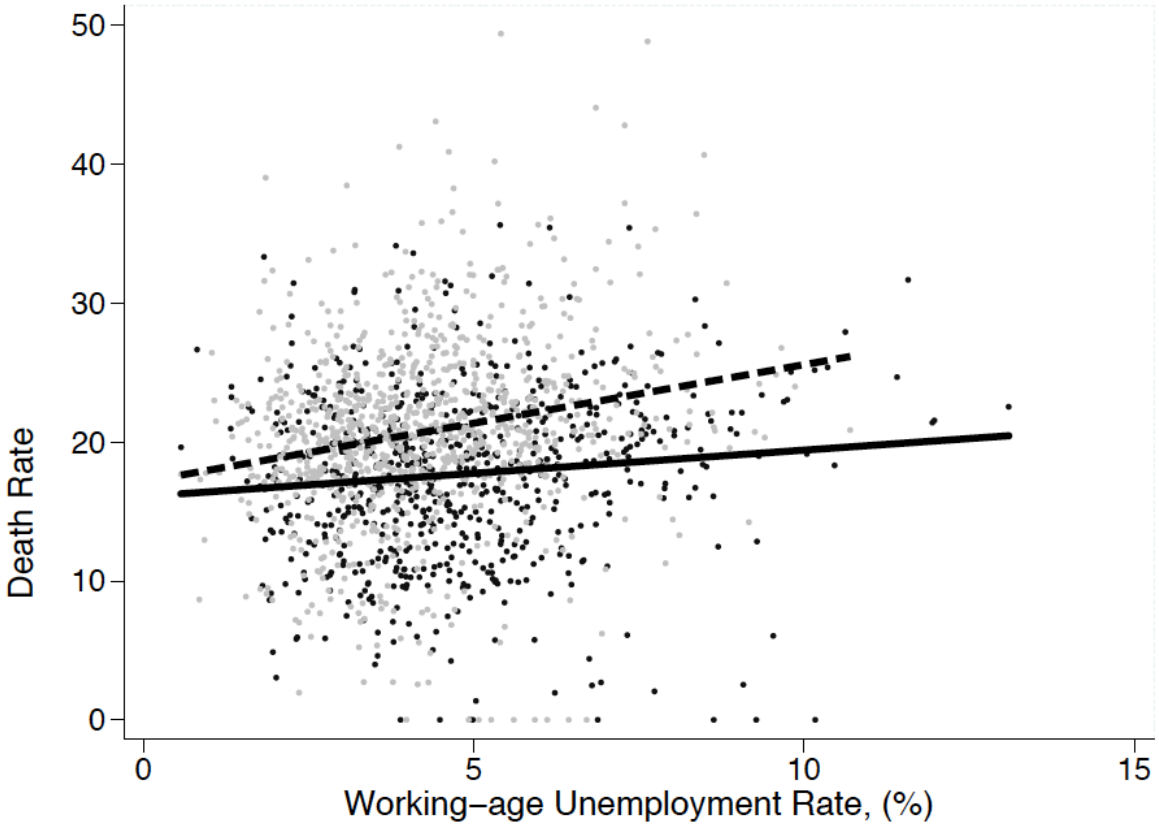

Figure 2. Lines of best fit through ordinary least squares model 3 predicted additional deaths per 100,000 population dependent on unemployment rates and unemployment benefit generosity

Legend: High/low benefit levels are above/below the mean level ($7990 US constant dollars per person). Predicted values are based on unemployment rates, unemployment benefit levels, and interaction term. The solid line is the predicted value for state-years with high benefits; the dashed line is the predicted value for state-years with low benefit levels.

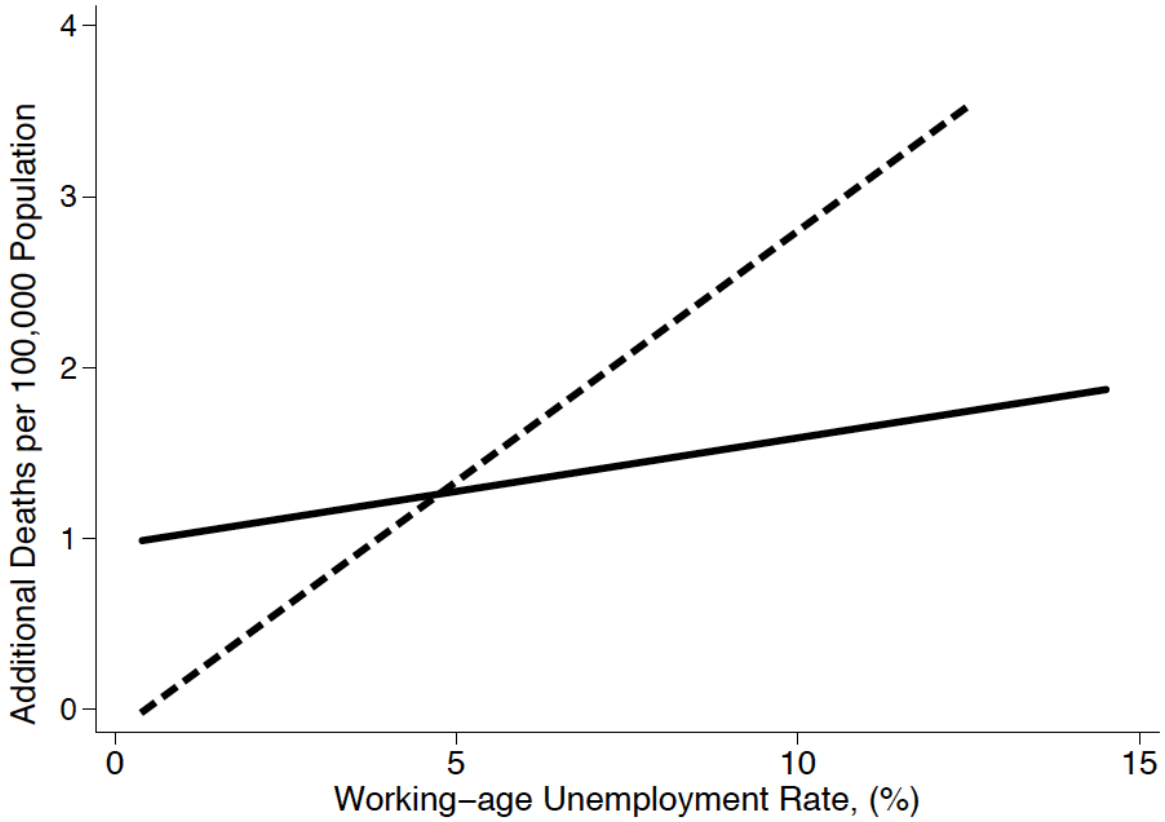

Figure 3. Additive unemployment rate*unemployment benefit interaction estimates stratified by age group and gender and 95% Confidence Intervals, United States, 1968-2008